consumed for the next year, up to Jan. 5, 1849, was but 7,457,700 cubic feet, which came to in money, 2,354*l.* 15s. 5d.; giving a difference of 692*l.* 18s. 5d. in the year.

The following extract from his evidence shows by what means this great saving was effected, and gives some idea of the sort of gas supplied to us.*

"Now, in the course of the year ending January 1849, did you adopt a purifying process?—We did.

Whose process?—Leslie's purifying machine.

During that year did you use the same quantity of burners that you had in use in the previous year?—Oh, no.

Did you use gas to the same extent for the purpose of light?—For the purpose of light we did.

And yet you consumed more than a million cubic feet less?—Certainly.

Now give the statistics of 1849.—The consumption of gas in the year ending Jan. 5, 1850, was 7,405,800 cubic feet, and the expense was 2,024*l.* 19s. 9d. [a further saving.]

Cross-examined by Mr. Hope.—You resorted to the purifying process, you say?—Yes.

Did you make any difference in the burners?—We had new burners introduced with the purifying machine, or rather the burners were introduced before the purifying machine, and we found we could not use them until we availed ourselves of the purifying machine.

When were the new burners put in?—We tried seven of Leslie's burners previous to that time, as I have stated, and we found that they would not answer.

Was that previous to the year 1847-48?—Yes, they became corroded and we were obliged to give them up, and Mr. Leslie then said it was owing to the impurity in the gas, and that the burners would go very well if we purified our gas, and the purifying machine was introduced, and these seven burners have been burning correctly up to the present day.

Then these burners were more economical than you had before, but were inapplicable until the gas was purified?—Just so.

Gas companies and gas fitters, if they be wise, will now no longer shut their eyes to the value of this burner.

We hope very soon to see a complete revolution in the domestic economy of heat and light, and certainly the exertions of those who can now see something like self-interest in preparing and pushing their way into public notice with such improvements, will not a little tend to promote the public interests in this respect, as well as their own. The gas companies, however, have still more power, and ought, for their own sakes, no less than for those of their anticipated customers, to adopt a liberal policy in respect to the supply and renting of meters, the fitting up of pipes and apparatus, payable by a per centage on outlay, and above all, by *the sine qua non* of all *their* future prospects of rising profits—perfect purity in the article designed to penetrate into private houses, and to wind its way into bedrooms and kitchens, as well as into drawing-rooms and parlours.†

* Some extraordinary experiments by Dr. Lyon Playfair touching this point are now before the Government.

† Since preparing the paragraph in last week's BUILDER on Gas from Water, we have learnt that Mr. Paine, the alleged discoverer or inventor of the process, holds some peculiar ideas on the constitution of water. If we understand it aright, he regards water as an element, at least as much as the oxygen eliminated from it, and alleges that *either* oxygen *or* hydrogen may be so eliminated, as either may be desired, by special electrical action. If such be Mr. Paine's idea, and if so wonderful a result have really been obtained by acting on such an idea, we must claim the original merit of that idea for a fellow countryman, Macvicar, of St. Andrews, who, at least twenty years since, wrote a curious treatise on chemistry, based on this and other original principles. Hydrogen, according to Macvicar, is the most elementary of all substances except "radiant matter" (and in this, indeed, Davy himself appears to have to some extent concurred). The form of its atoms or particles is the most elementary or simplest as well as most centre of all possible corporeal forms, namely, the tetrahedron. Oxygen, water, and all other substances are composed of these tetraedra united by electrical affinity in various modes and numbers, constituting composite or quasi-elementary atoms or molecules. Water, then, is either solely hydrogen (when entirely resolved into an elastic medium of tetraedra), or partly hydrogen and partly oxygen (when some of these hydrogenous atoms remain in the closer conjunction constituting the oxygenous nature). *Query* as such ideas may appear to a mere esoteric chemist, we have heard Macvicar spoken of most respectfully by a chemist of celebrity in his day, and himself a respected correspondent of Davy and Faraday, namely, Kemp. As to Mr. Paine's mode of eliminating hydrogen from water, we are led to believe that he alleges either oxygen or hydrogen may be so eliminated according as the one positive or negative electricity. Now, we will venture to anticipate that if Mr. Paine have really tested and proved the truth of Macvicar's idea of the constitution of water, as resolvable into hydrogen, it must be by negative electricity (the singular affinity of which to the radiant corpuscles of the solar ray we have already noted in THE BUILDER) that he eliminates the hydrogen. A word to the wise in these days may save us, at least, if not the American coin, from the private appropriation of so great and universal an idea under *patent* lock and key. And to this end we would further hint that by connecting the whole series of zinc plates in a galvanic battery with a separate and isolated trough containing sulphur, a high electro-negative, we long ago obtained decided manifestations of electrical action in the clustering of the sulphur round the single pole or wire communicating with the series of zinc plates while the ordinary galvanic circle was closed and the trough in action. Other pursuits prevented, as they still do, any further investigation of this peculiar train of experiment, but it seems to bear on the subject of the present note. Mr. Paine, we understand, has agreed to arrangements for a trial of his apparatus at Astor House, New York.

ON THE STRUCTURAL PRINCIPLE OF THE ROOF OF WESTMINSTER HALL.

AND THE INDICATIONS OF A DISUSED METHOD OF SUPPORTING ROOFS.*

HAVING a few years ago treated on mediæval wooden roofs, and endeavoured to exemplify the structural principle of that of Westminster Hall, I have not read with indifference some recently published adverse opinions.

As the opinions alluded to arose from the review of a popular and very useful collection of open timber church roofs, it may be at once stated that these are so inferior in size and scientific development to the finer domestic specimens (the boldest ecclesiastical example scarcely exceeding thirty feet, while Westminster Hall is sixty-eight feet wide), that I regard the volume in question and its authors as perfectly unobnoxious to remark in a critical consideration of the matter.

Those, indeed, who, from a conviction of the highly suitable and effective character of the open wooden roof for sacred as well as civil edifices, would wish to revive and extend its application at the present time on true principles, will, I think, prosecute their object with the fairest aim at excellence, by the diligent examination of those stupendous examples devoted to secular uses, in which the resources of art are most fully displayed. They will thus be best prepared to impart intrinsic merit to ecclesiastical works, too often left to rest their claim for respect on embellishments received from the carver or the colourist.

Had we examples of this latter kind only, notwithstanding the poetically typical significance and elaboration of detail possessed by many, the charge against our ancestors of a total failure to assimilate open roofs with the compressible architecture, or that called Gothic, might have remained uncontroverted; but, fortunately, we have instances of the most successful treatment, and of such none are more worthy of admiration, both for unapproached magnitude and ability of contrivance, than that of Westminster Hall. A recognition of the true system of its construction is calculated to be highly conducive to the progressive excellence of such works; and I shall esteem it a great satisfaction to be, however humbly, useful in so desirable a result.

Two authorities condemnatory of this roof have been brought more prominently forward, namely, Mr. Bartholomew and Dr. Robison. The first of these says, "No work on the earth perhaps exhibits more excellence of workmanship, and perhaps none shows more assiduity and skill of an inferior kind, to obviate the thrusting power of the roof; but, the whole being constructed on false and unscientific principles, it is in vain that this want of science is concealed by intricacy of framing and excellence of workmanship." If I am not mistaken, the writer here quoted has been entirely misled by the intricacy of the merely subordinate panelling or tracery; but as this will presently be more fully entered into, I shall proceed to Dr. Robison's view of the case.

"Westminster Hall," he says, "exhibits a specimen of the false taste of the Norman roofs. It contains the essential parts, indeed, very properly disposed, but they are hidden, or intentionally covered, with what is conceived to be ornamental (and this is an imitation of stone) arches, crammed in between slender pillars, which hang down from the principal frames, trusses, or rafters. In a pure Norman roof, such as Turnaway Hall, the essential parts are exhibited as things understood, and therefore relished."

It is surprising that a paragraph, betraying such extreme ignorance of dates and architectural characteristics, should have emanated from a writer of the Doctor's standing, even in the last century; and yet more astonishing that it should be put forward by a professional critic of the present day. It clearly shows, however, the impression that the internal parts of the truss really depend from the main rafters. Excepting the lower part of the walls, the Norman hall of William Rufus was rebuilt three centuries afterwards by Richard the Second, who, on its completion in the year 1399, solemnised Christmas by a characteristically splendid feast; and every lineament of the roof, so far from partaking of the Norman manner, proclaims its origin to have been late in the fourteenth century.

The error in thus following Dr. Robison might alone warrant a doubt, whether the concealments of which the writer who quotes him speaks actually exist, and whether his assertion, that "constructive principles, if true, must be anti-Gothic; that to make open roofs beautiful and truthful, all Gothic ideas must be relinquished," &c., have received from himself the reflection befitting their unqualified expression. With respect to the remaining portions of the critique alluded to, I may say, with the editor of the journal in which it appeared, "that his arguments have not convinced ourselves;" and then I will proceed to bring under notice the key to the construction of this truly wonderful example of carpentry.

My observations go to show, that the arch is not merely a very grand ornamental feature, but that it is absolutely the essential principle and weight-sustaining medium of the truss; and should this hypothesis prove correct, the propriety of the Gothic, or the compressible system of design in carpentry, must, I conceive, be admitted.

Commencing then with the great arch rib, which in its section is upwards of two feet each way and spans the width of the hall, we find, that dividing the curve from the springing to the apex into three parts, the first of such divisions gives a point in the rib, at which it is intersected by a massive horizontal beam of nearly equal dimensions with itself. This horizontal timber, called the hammer-beam, extends outwards to the foot of the rafter, and is continued in the opposite or inward direction to the same extent, so that if secured on a central pivot, this timber might be acted upon as a scale-beam or lever of the first order, and if loaded equally at both ends, would remain in its horizontal position, while the entire weight would be concentrated at the pivot, and thrown upon the supporting arch. If, taking the hammer-beam as a base, we draw a perpendicular line from the inner extremity, it will be found to cut the rafter, or surface of the roof, just midway between the foot and the ridge, and taking this rafter or surface line as the hypotenuse, a triangle will be completed.

This triangle will be found to have an exact counterpart in the upper half of the roof; but, as the weight is proportionate to the superficial area, it is only necessary to explain, that this area is divided longitudinally into two equal parts; that under this divisional line a purlin exists, upon which is collected the weight of the upper half of the roof, and this weight is transmitted, by a vertical post, to the inner end of the hammer-beam. The lower half of the roof discharges, in like manner, its weight on the outer end of the same timber, and the equipoise is thus rendered perfect.

If the accuracy of this much be conceded, I think but little remains for discussion. The fitness of the skeleton for its intended purpose once seen and admitted—the graceful adaptation of the tracery and minor arrangements for supporting the slighter parts by aid from the stronger will be manifest, and especially so, when it is recollected that gravitation is not the only force to be resisted; but that the powerful action of the wind, on so large a plane, has also to be largely provided against. In tracing the history of these roofs, I have formed the opinion, that their type is found in the stone gablets, or principals, employed in early halls, of which Conway Castle affords good examples, and a specimen also exists in the Manor-house at Ightham, in Kent.

Professor Willis says:—"A small chapel at Capo di Bove, about a mile outside Porta S. Sebastiano, Rome, figured by Agincourt, has the roof entirely sustained by a series of pointed arches, resting on corbels, and entirely superseding the usual trusses." The more ancient employment of such gablets may be further referred to in the aisles of Hartlepool

* Read at a meeting of the Institute of Architects, 24th June.

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